

MODULAR SENSOR PLATFORM

Statement of Government Interest

The invention described herein may be manufactured, used
5 and/or licensed by or for the United States Government.

BACKGROUND OF THE INVENTION

[0001] Robotic agents will be ubiquitous on future battlefields,
principally to lower the exposure of harm to ground forces.

10 Teams of small collaborating robotic agents, having advanced
sensor and mobility characteristics, can be utilized to conduct
tasks such as reconnaissance and surveillance, chemical and
biological agent detection, logistics, and communications relay.
These robotic agents can also be utilized to operate in hostile
15 environments or adverse weather conditions outside of armed
forces applications.

[0002] Present robotic agents are generally not designed to be
used in harsh environments. Current robotic endeavors utilize
state of the art components attached to the top of a base with
20 component interfaces and connections (wires) exposed.
Additionally, these components are permanently affixed to the
base, or embedded into the system, requiring a great deal of time

and effort to remove and replace in case of equipment malfunction or system upgrade.

[0003] The overall configuration of these robotic agents is not designed to be modular, thereby precluding the use of rapid change components due to replacement due to failure or task changes. Specifically, prior art robotic agents are not water resistant, thermally protected or protected from dust or dirt. Since these agents typically carry sensitive sensors and devices, their lack of protective elements limit their application.

SUMMARY OF THE INVENTION

[0004] The present invention overcomes the difficulties of known robotic agents by providing a system which allows the robotic agents unlimited applications in all types of weather and environmental conditions. Furthermore, the present invention provides multiple changes of modular components, thereby providing quick removal of inoperative or damaged parts, as well as allowing for customizing a basic agent for particular use.

[0005] It is, therefore, an objective of the present invention to provide a platform system that is quickly attached to vehicular device having a drive train and power supply, where the platform system provides remote data acquisition and transmission.

[0006] It is also an objective of the present invention to provide a system for rapid removal, reconfiguration and exchange of components that is easily manipulated and capable of housing a variety of components necessary for information gathering and transmission applications in a wide variety of environmental and weather conditions.

[0007] It is also an objective of the present invention to provide a platform system that is capable of being quickly opened so as to allow quick repair, removal, maintenance or upgrade of all apparatus and sensors, all components housed within the platform interior and track all wires connected to each of the apparatus, sensors and components.

[0008] It is also an objective of the present invention to provide a platform system that is capable of being opened in a second position to allow direct access to all portions of the robotic components.

[0009] It is also an objective of the present invention to provide removable side panels that allow an alternative means of accessing the interiorly housed components and wires as well as effectuating rapid removal of all apparatus, sensors, components and wires.

[0010] These and other objectives have led to the present invention discussed below.

DESCRIPTION OF THE FIGURES

[0011] **Figure 1** shows a top view of the platform system of the present invention.

5 [0012] **Figure 2** shows a side view of the platform system of the present invention.

[0013] **Figure 3a** shows an alternate system access position of the platform system of the present invention.

[0014] **Figure 3b** shows an interior configuration of the platform system of the present invention.

[0015] **Figure 3c** shows an alternate drive level access position of the platform system of the present invention.

[0016] **Figure 3d** shows a rear view of the platform system of the present invention.

15 [0017] **Figure 4** shows the platform system of the present invention positioned on a robotic vehicle.

[0018] **Figure 5** shows a top view of the alternate embodiment of the platform system of the present invention.

20 [0019] **Figure 5a** shows a side view of the alternate embodiment of the platform system of the present invention.

[0020] **Figure 5b** shows an alternate position of the alternate embodiment of the platform system of the present invention.

[0021] **Figure 5c** shows an interior configuration of the alternate embodiment of the platform system of the present invention.

[0022] **Figure 6** shows the alternate embodiment of the platform system positioned on a robotic vehicle.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0023] The present invention is directed to a platform system that provides a new and unique manner for housing a plurality of apparatus and sensors storing their respective components and related hardware such that they are rapidly exchangeable, water resistant and capable of operating in a wide range of environmental and weather conditions. The platform system of the present invention is capable of operating as a stationary unit or may be placed upon vehicles having existing robotic units. The modular platform system is capable of accommodating a wide variety of sensors and apparatus for remote data recording, imaging and transmission.

[0024] As shown in **figure 1**, the platform system 1 includes an upper portion 2, a first side 3a, a second side 3b, a front portion 4 and a back portion 5. The upper portion 2 also includes an outer top surface 6.

[0027] **Figure 3(a)** shows a preferred embodiment of the present invention. Upper portion **2** is hinged with quick-release hinges **2a** to allow upper portion **2** to be lifted away from front portion **4** and base portion **7** and provide access to interior portion **2b**. To
5 maintain the upper portion **2** at an open position as shown in figure **3(a)**, a pair of gas-charged lift supports **2c** (proximate to side **3a**) and **2d** (proximate to side **3b** and not shown) control the rate of ascent to the completed open position. Similarly, gas-charged lift supports **2c** and **2d** also control the rate of descent
10 to prevent inadvertent closing.

[0028] As shown in **figure 3(b)**, the hinges **2a** allow the interior portion **2b** to be accessed. The interior portion **2b** of upper portion **2** serves as a housing for wires connecting the devices to their respective power sources and the like. In
15 particular, interior portion **2b** provides a wire housing system **W** that is used to maintain wire integrity between each apparatus and sensor and their respective components. The wire housing system **W** effectuates an efficient and rapid manner by which each apparatus' wiring can be easily tracked and identified for rapid
20 maintenance and/or removal. Additionally, wire housing system **W** also insulates the wiring from sudden jolts and vibrations when the system **1** is in motion. Interior portion **2b** also includes a plurality of brackets **B** for holding individual components of the

devices positioned on surface 6 (the interior portions of panels 6a, 6b, 6c and 6d, as shown). The brackets B provide additional stability, shock and vibration isolation that prevent sudden jolts and vibration from reaching the components when system 1 is in motion. Note that the positions of the wire housing system W and the brackets B are generally shown in figure 3(b). Exact positioning of these elements will be dependant upon design and functional parameters as understood by one of ordinary skill in the art.

[0029] Figure 3(c) shows a preferred embodiment of the present invention. Upper portion 2 and base 7 are also configured with quick release hinges 2d to allow both upper portion 2 and base 7 to be lifted away from front section 4, and/or removed. This mechanism allows for easy access to all data ports and wiring related to the locomotion including a drive train and power supply of the device. In this configuration, a bottom front portion 8 remains in a stationary position. An interior section 8a of bottom front portion provides a storage area for additional components or the like.

[0030] As shown in figure 3(c), when both upper portion 2 and base 7 are raised, a support mechanism 9 having a catch 9a and a rod 9b maintains the upper portion and base in the raised position. A safety cable 9c will prevent the upper portion 2 and

base 7 from opening too far in the ascending direction before 9a and 9b can be attached. Quick release latching mechanisms 9d (proximate to side 3a) and 9e (proximate to side 3b and not shown) allow for rapidly opening and closing upper portion 2 and base 7.

[0031] Figure 3(d) shows the back portion 5 of the system 1. The back portion 5 includes additional access panels 5a and 5b positioned on upper portion 2. Access panels 5a and 5b are screwed into back portion 5. Alternatively, panels 5a and 5b can be hinged and fastened onto back portion 5 using quick release hinges and fasteners. Figure 3(d) also shows quick release hinges 2a that allow for upper portion 2 to be raised, as discussed above. Figure 3(d) also shows quick release hinges 2d which allow upper portion 2 and base 7 to be jointly raised, as discussed above. Back portion 5 also include sonar sensors 5c and 5d as well as a recessed interface panel 5e into which additional apparatus including other robotic mobile units can be connected to pass signal data and power.

[0032] Figure 4 shows a preferred embodiment of the present invention where the platform system 1 is positioned onto and attached to a robotic vehicle, R having a drive train and power supply. First side 3a provides air flow apparatus 3c and 3d (and air flow apparatus 3e and 3f on side 3b, not shown). Front

portion 4 includes an aperture 4a into which a scanning laser
rangefinder (LADAR) is positioned. Front portion 4 also includes
sonic sensors 4b. System 1 also allows for a plurality of
apparatus and sensors A to be positioned on plates 6a, 6c and 6d,
5 as shown. As discussed above, system 1 allows the robotic
vehicle R to obtain and transmit data in harsh environments and
weather conditions. The platform system 1 provides a water, dust
and dirt resistant enclosure mechanism which protects the sensors
and apparatus from damage while at the same time providing a
mechanism by which individual apparatus/sensor(s), components of
the apparatus/sensor(s) including all wiring can be easily
accessed, maintained and repaired.

[0033] Figure 5 shows another embodiment of the present
invention. As shown, the platform system 101 includes an upper
portion 102, a first side 103a, a second side 103b, a front
portion 104, and a back portion 105. The upper portion 102 also
includes an outer top surface 106.

[0034] Outer top surface 106 includes at least two plates 106a
and 106b that are attached to the surface 106 via screws S. The
20 plates 106a and 106b are used to hold a plurality of apparatus
and sensors A including but not limited to an 8-microphone
acoustic array, a visible camera, an infrared camera, a scanning
laser rangefinder (LADAR), a point laser rangefinder, 12 sonar

sensors, 3 CPUs, 2 wireless LANS, a video transmitter, a GPS sensor, a digital compass, a weather sensor, a stereo camera pair and a driving camera. Additional and/or alternate plates may be added to the top surface 106 depending upon the number and type of apparatus utilized.

[0035] Side portion 103a includes a side panel 103c, and side portion 103b includes a side panel 103d. Panels 103c and 103d are attached to their respective panels via screws S. Additionally, panels 103c and 103d may be hinged, utilizing quick release hinges, along the bottom edges (not shown) and fastened using known fastening apparatus. Side panels 103c and 103d, as shown in figure 5, also includes air flow apparatus 103e. Air flow apparatus 103e include filters, fans and vents to provide necessary air flow to prevent components and wiring from overheating.

[0036] Front portion 104 includes an aperture 104a for positioning a LADAR within. Additionally, front portion 104 includes front side panels 104b and 104c which are attached to front portion 104 via screws S. Back portion 105 includes a panel 105a which is attached to back portion 105 via screws S and a back dock 105b. The back dock 105b provides easy access to other robotic apparatus to board and integrate with system 101. Alternatively, the back dock 105b may be replaced with a

dispenser for ground sensors, an arm mechanism for retrieving objects, placing objects or performing functions with various arm attachments as will be understood by one of ordinary skill in the art. Alternatively, back dock **105b** may be replaced with a spool
5 for tethering in bad radio frequency environments. Additionally, all of the panels/plates **103c**, **103d**, **104b**, **104c**, **105a**, **106a** and **106b** are removable from system **101**.

[0037] **Figure 5(a)** shows the first side portion **103a** with side panel **103c**, removed to provide a quick and efficient manner to
10 access interior portion **102a**. Similarly, **figure 5(a)** shows front side **104** with front side panel **104b** removed to provide a quick and efficient manner to access interior portion **102a**. Interior portion **102a** houses components and wiring for the apparatus and sensors positioned on surface **106**.

15 [0038] Similar to system **1**, as shown in **figure 3(b)** (and, therefore not shown), interior portion **102a** provides a wire housing system that is used to maintain wire integrity between each device and their respective components. The wire housing system effectuates an efficient and rapid manner by which each
20 apparatus' wiring can be easily tracked and identified for rapid maintenance and/or removal. Additionally, the wire housing system also insulates the wiring from sudden jolts and vibrations when the system **101** is in motion. Interior portion **102a** also includes

a plurality of brackets for holding individual components of the devices positioned on surface 106. The brackets provide additional stability, shock and vibration isolation that prevent sudden jolts and vibration from reaching the components when system 101 is in motion. Note that the positions of the wire housing system and the brackets are dependant upon design and functional parameters as understood by one of ordinary skill in the art.

[0039] Figure 5(b) shows another preferred embodiment of the present invention. Upper portion 102 and base 107 are hinged with quick release hinges 102b to allow both upper portion 102 and base 107 to be lifted. This mechanism allows for easy access to all data ports and wiring related to the robotic devices upon which the system 101 is positioned. In this configuration, front portion 107a remains in a stationary position. An interior section 107b of front portion 107a provides storage areas for component storage or the like.

[0040] As shown in figure 5(c), when the upper portion 102 and base 107 are raised, a fastener mechanism 108, having a catch 108a and a rod 108b maintains the upper portion 102 and base 107 in the raised position. A safety cable 108c prevents the upper portion 102 and base 107 from opening too far in the ascending direction before catch 108a and rod 108b are attached. Quick

release latching mechanisms **109a** (proximate to side **103a**) and **109b** (proximate to side **103b** and not shown) allow for rapidly opening and closing upper portion **102** and base **107**.

[0041] **Figure 6** shows a preferred embodiment of the present invention where the platform system **101** is positioned and attached onto a robotic vehicle, **R** having a drive train and a power supply. Front portion **104** includes an aperture **104a** provides a secure area into which a LADAR can be positioned. Front portion **104** also includes removable front side panel **104b**. System **101** provides for a plurality of apparatus and sensors **A** to be positioned on plates **106a** and **106b**, as shown. System **101**, as discussed above, allows the robotic vehicle **R** to obtain and transmit data in harsh environments and weather conditions. The platform system **101** provides a water, dust and dirt resistant enclosure mechanism which protects the sensors and apparatus from damage while at the same time providing a mechanism by which individual apparatus/sensor(s), components of the apparatus/sensor(s) including all wiring can be easily accessed, maintained and repaired.

What is claimed is: